TERRA TXN 960

NAV/COMM/ECDI

INSTALLATION AND OPERATION MANUAL

TERRA CORPORATION

TERRA CORPORATION
3520 PAN AMERICAN FREEWAY N.E.
ALBUQUERQUE, NEW MEXICO 87107-4796
505 884-2321
FAX 505 884 2384

VERIFIED CURRENT
AUG. 6, 1996

BY L.M.

Part Number 1900-1699-00
REV. C, ECO #1126

TXN 960 NAV/COM ECDI

TERRA CORPORATION

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TERRA CORPORATION

SECTION I

1. INTRODUCTION

1.1 SCOPE

This manual provides installation and operating instructions for the Terra TXN 960 self-contained Nav/Comm/ECDI system manufactured by Terra Corporation, Albuquerque, New Mexico.

1.2 DESCRIPTION

The Terra TXN 960 is an all solid-state, self contained 720 channel transceiver, 200 channel navigation receiver with an electronic course deviation indicator. The TXN 960 utilizes state-of-the-art components to increase reliability and quality.

The Comm portion is an amplitude modulated VHF transceiver. It provides simplex communication on any one of 720 channels with 25 KHz channel spacing. The transceiver features a digital frequency synthesizer that employs only four crystals for generating the frequencies required for all 720 transmit and receive channels. Other features include automatic voice leveling on transmit and receive, crystal monolithic IF filters and integrated circuit IF amplifiers, a low noise MOSFET RF amplifier, automatic squelch circuit with manual override, solid-state antenna switching and tuning.

The navigation receiver features a digital frequency synthesizer that employs 2 crystals for generating the frequencies required for all 200 channels with 50 KHz channel spacing. Other features include automatic gain control, crystal monolithic IF filters, integrated circuit IF amplifiers and solid-state tuning.

The optional glideslope section is a 40 channel glideslope receiver tuning the band from 329.00 MHz to 335 MHz in 150 KHz steps, furnishing glidepath indication and flag information to the ILS indicator.

1.2 DESCRIPTION (Continued)

The electronic course deviation indicator is a microprocessor based navigation instrument. It processes standard composite navigation and glideslope signals from the Nav receiver with an optional input from a second Nav receiver. Signals are then processed to drive the gas discharge display for pilot information. VOR bearings are calculated from the NAV inputs and displayed in numeric form. A selected OMNI bearing may be compared to the decoded output. The result of this comparison is a bar type presentation indicating course deviation. In the ILS mode the Localizer and glideslope signals are decoded and the bar display indicates left-right and/or up-down corrections. Another optional feature available is the capability to display Loran C bearing information.

The TXN 960 requires 13.75 volts for operation. A Terra MLC 28-5 DC converter is required for 27.5 volt operation.

1.3 SPECIFICATIONS

MECHANICAL SPECIFICATIONS

Mounting:	Panel mounted using mounting tray supplied.
Overall Dimensions:	9.6" long, 6.2" wide, 3.1" high.
Mounting Dimensions:	10.4" behind panel, 6.25" wide, 3.3" high.
Weight:	4 lbs. with glideslope, 3.7 lbs. without glideslope, mounting tray .6 lbs.

Power Requirements: 13.75 VDC input
- Standby - 600 mA typical
- Full audio - 1 amp typical
- Transmit - 2.5 amp typical
- Instrument lights - 300 mA typical

ELECTRICAL SPECIFICATIONS

Comm Transmitter:

Frequency Range:	118.00 to 135.975 MHz
Number of channels:	720

1.3 SPECIFICATIONS ELECTRICAL (Continued)

Channel Spacing: 25 KHz

Frequency Stability: .002% per FCC Type Acceptance

Power Output: 5 Watts nominal, unmodulated carrier; 20 Watts PEP

Modulation: Automatic audio leveling for a minimum of 80% and a limit of 95%

Output Termination: 50 ohms nominal

Spurious Responses: Greater than 50dB below carrier level

Sidetone: Up to 25 milliwatts into 600 ohm headphones

FCC Approval: Type Accepted per FCC Part 87

Comm Receiver:
Frequency Range: 118.00 to 135.975 MHz

Number of Channels: 720

Channel Spacing: 25 KHz

Sensitivity: Less than 1 microvolt for 6dB signal plus noise to noise ratio

Selectivity: Typically -6dB at 14 Khz; -60dB at 40 KHz

Squelch Sensitivity: Automatic 5 to 10 microvolts; manual 25 to 250 microvolts

Automatic Gain Control (AGC): Audio flat within 3dB for 3 microvolt to 30,000 microvolt input

Undesired Response: Greater than 60dB down

Adjacent Channel Rejection: Greater than 60dB

Accidental Radiation: Certified per FCC Part 15 requirements.

1.3. ELECTRICAL SPECIFICATIONS (Continued)

Nav Receiver:

Frequency Range: 108.00 to 117.95 MHz

Number of Channels: 200

Channel Spacing: 50 KHz

Sensitivity: 1.0 uV for 6dB S+N/N ratio

Selectivity: Typical 6dB at +17 KHz, 50 dB at +50 KHz

Glideslope Receiver:
Frequency Range: 329.150 to 335.00 MHz

Number of Channels: 40

Channel Spacing: 150 KHz

Sensitivity: 20 uV hard

ECDI
Nav Input Impedance: 1 megohm

Nav Input Level: 50 uV to 10VRMS

Loran C output requirements to drive TXN 960:
Flag Input: 150 uA for ELC operation
Deviation: +150 uA for full right
-150 uA for full left

Performance:
VOR - Accuracy: +2 degrees
Max. deflection: 10 deg. = 14 bar deflection

Localizer - Deflection: 7 bars +1 bar deflection for 0.093 ddm
Centering error: +1 bar
Glideslope Deflection: 7 bars +1 bar deflection for 0.175 ddm
Centering error: +1 bar

SECTION II

2. INSTALLATION AND OPERATION

2.1 GENERAL

This section contains all necessary installation and operating instructions for the Terra TXN 960.

2.2 PREPARATION FOR USE

Every precaution has been taken to protect your TXN 960 during shipment. Upon receipt of the equipment, perform the following inspections:

1. Remove the unit from the shipping container and visually inspect for damage.
2. Check controls and switches to determine if they may have been damaged.
3. Make sure that all hardware and connectors listed in Section II under "Equipment Supplied" are present.

If the unit is damaged, a claim must be filed with the carrier. Retain the shipping carton and contact Terra Corporation for shipping instructions.

2.3 EQUIPMENT SUPPLIED

1. 1 ea. Terra TXN 960 self-contained Nav/Comm/ECDI system.
   Option #1 - without glideslope, Terra part number, 0900-0728-00
   Option #2 - with glideslope, Terra part number, 0900-0728-10
   Option #3 - with Loran C, without glideslope, Terra part number, 0900-0728-20
   Option #4 - with Loran C, with glideslope, Terra part number 0900-0728-30

2. 1 ea. Mounting Tray (sleeve), with glideslope, Terra part number 1900-1703-10
   without glideslope, Terra part number 1900-1703-00

3. Insure that adequate clearance exists behind the panel for the mounting tray and cable assemblies. A minimum of 11" is recommended.

4. Refer to Terra TXN 960 Outline Drawing for panel cutout details and mounting dimensions.

2.3 EQUIPMENT SUPPLIED (Continued)

5. Install the tray assembly on the instrument panel supports with the open side of the mounting tray towards the top. Comply with standards set forth in the FAA Aircraft Inspection & Repair Document AC 43.13.2.

6. A rear support bracket should be utilized to prevent resonant vibrations.

7. A 50 ohm broad band VHF communications antenna covering the range of 118.00 to 135.975 MHz is recommended. Whips or bent rod are not recommended if the radio is to be used over its entire frequency range.

8. Connect the antenna to the Terra TXN 960, using standard 50 ohm coaxial cable such as RG 58A/U. Terminate the cable with BNC coaxial cable connectors as required. **CAUTION!** Proper installation of the coaxial cable and the antenna per FAA Aircraft Inspection & Repair Document AC 43.13.2, chapter 3, is very important to prevent possible mismatch of the transmitter output.

2.4 ELECTRICAL INSTALLATION

1. Fabricate the necessary cable assemblies per TXN 960 Interconnect Diagram and the standards set forth in FAA Aircraft Inspection & Repair Document AC 43.13.1, Section 7.

2. Install the cable assemblies to their power connector bracket and then mount them on the rear of the mounting tray assembly.

3. Complete the interconnecting wiring to the aircraft system.

4. The Terra TXN 960 system operating voltage is 13.75 VDC. If the aircraft electrical system is 28-24 VDC, it will be necessary to utilize a converter rated at 5 amps to reduce the aircraft bus voltage to 13.75 VDC. The Terra MLC 28-5 is specifically designed for this purpose.

5. Install the TXN 960 in the mounting tray assembly. Use caution as the rear connectors mate. After the float mounts are positioned

2.4 ELECTRICAL INSTALLATION (Continued)

correctly, the unit will fully engage the connectors with light to medium pressure on the front panel.

6. Insert a 7/64" Allen wrench in the front panel hole and engage the locking screw. Turn clockwise until the cam has engaged itself in the tray and is moderately tightened. Use caution to prevent stripping the threads on the locking cam or screw.

7. To remove the unit from the mounting tray, insert the 7/64" Allen wrench in the locking screw and turn counterclockwise. The cam will move the unit outwards about 1/4" and disengage the connectors. The unit may now be pulled out of the mounting tray by hand.

OPERATION

Communications:

1. Rotate the Comm volume control clockwise to turn on the TXN 960.

. Adjust to desired frequency by pressing either upper or lower frequency select switches on Comm.

Rotate squelch control until switch clicks into a fully counter-clockwise position. This is the automatic squelch mode. No background noise should be heard. Adjusting the squelch control in a clockwise direction activates the manual squelch mode. Rotate the control clockwise until background noise is heard, then rotate it slightly counter-clockwise until noise stops.

Adjust volume control for desired level during receipt of transmissions.

Plug a microphone into the aircraft microphone jack.

Verify transmitter operation by communicating vith another station. Verify at high, middle nd low frequency channels if possible.

lug a headset into the aircraft headphone ack and observe the quality of output. If

transmit sidetone and/or intercom is used verify quality and level in headset.

Nav Receiver

1. Rotate the Comm volume control clockwise to turn on the TXN 960.

2. Adjust to desired frequency by pressing either upper or lower frequency select switches on Nav.

3. Adjust Nav Volume control for desired level.

4. Rotate IDENT switch counter-clockwise for "voice" reception or clockwise for "IDENT".

The OBS course selector is a small knob on the lower left of the instrument. The OBS course selector is a bi-directional two speed continuous control used to set the desired course. The slow speed rate is approximately one degree per half turn and high speed is 10 degrees per half turn. This control has no effect on localizer operation other than to provide a reminder of the desired course or possibly the missed approach VOR bearing.

The course display is a three digit electronic display which indicates the selected course, bearing "TO" or radial "FROM" the VOR station. Courses from 000 to 359 degrees may be selected in one degree increments.

The TO/OBS/FR/BC selector switch is normally positioned in the OBS position which allows the OBS course selector to be active. The TO position causes the course display to automatically change to give a continuous bearing "TO" the VOR station and the course deviation bar will remain centered.

The FROM position causes the course display to change automatically to indicate continuously the radial "FROM" the VOR station and the course deviation bar will remain centered. During ILS operation, the TO/OBS/FR/BC selector is used to select BC in the down position or normal operation in the middle or upper position. BC is for making a back course localizer instrument landing.

The mode display is in the upper left quadrant of the display. The TO FROM ambiguity indicates "T"

for TO the VOR, "F" for FROM the VOR. When making an instrument approach where only a localizer is present, the mode display will display an "L" for localizer. When both a glideslope and localizer are present, the mode display will exhibit an "I" for ILS. Should a back course localizer approach be desired, the TO/OBS/FR/BC switch shall be set to "FR/BC", the mode will display a "b" for back course. When invalid information or no signal is present, the mode display will display an "o" for OFF. (The mode will display "g" for glideslope approaches.)

The course Deviation Bar indicates deviation from the selected course. The ends of the display bars have arrows to point the direction to fly to stay on course. The more display bars that are illuminated, left or right, up or down, the greater deviation from course. Fully lighted deviation bars indicate a full 10 degrees right or left. There are 14 light bars each side of center in the deviation scale; therefore, each bar represents approximately 0.7 degree deviation in the VOR mode. When exactly on course, indication will be by two vertical bars in the VOR/LOC mode.

Since the display has no meter movements and is entirely electronic, a wider course width scale is available. The actual VOR and localizer course widths at full scale are the same as conventional needle-type instruments; however, since the scale is larger, smaller off course indications can be seen which means that corrections can begin sooner without overcorrecting.

The Glideslope Deviation Bar indicates deviation from the glideslope centerline. A flagged indication for glideslope is no vertical bar(s) up or down. On an approach mode, if a valid glideslope signal has been received and then the glideslope signal is lost, the top 4 bars and arrow will begin flashing to indicate this. Also the mode indicator will revert to "L" for Localizer instead of "I" for ILS.

In the lower right quadrant a feature allows you to display a second NAV VOR radial digitally. This allows two different NAV receivers to be displayed on a single indicator. Typically, NAV 1 would be displayed on the OBS deviation bar and NAV 2 would

be displayed on the NAV 2 digital radial display. The lower right toggle switch allows you to select the digital window radial reading "TO" the VOR station. Selecting FR allows you to select the "FROM" radial from the VOR station. The lack of a second or NAV 2 signal will cause the window to read OFF. A remote switch can be installed to transfer NAV 2 to the NAV 1 position. A digit numeral 2 will light in the 1 position.

When the lower right switch is positioned in the center position a 0 to 10 minute timer is activated to aid in standard rate turns, etc. The time can be reset by switching up or down and moving back to center. Time will immediately be restarted from zero and will count minutes and seconds.

A push-button to the right of the NAV 2 TO/TIME/FR switch has two functions. When the NAV 1 TO/OBS/FR/BC switch is in the TO or FR position and the OBS/TEST button is momentarily pushed and then the NAV 1 switch is moved to the OBS position, the unit will automatically center, putting you right on course center line TO or FROM the VOR station. This feature saves rotating the OBS knob to find the radial TO or FROM the VOR.

When the OBS/TEST push-button is pushed with the NAV 1 switch in the OBS position, the unit tests all light bars and digital segments. During test the light bars are strobed and 8's are displayed in each of the digital windows.

2.6 FLYING THE ECDI WITH LORAN C OPTION

Most of the operation of the ECDI will remain the same. However, there are some differences which will be explained in this section.

The NAV 2 TO/TIME/FROM selector now becomes the Loran C/TIME/OFF selector. When this switch is in the OFF position, NAV 1 bearing and deviation will be displayed. Switching from OFF to TIME will give the same indications as explained before.

When the switch is moved to the Loran C position, deviation from NAV 1 will no longer be displayed. If the NAV 1 selector is in the TO or FROM position, the NAV 1 radial will still be displayed. With an invalid Loran C signal, C will

2.6 FLYING THE ECDI WITH LORAN C OPTION (Continued)

be displayed in the mode indicator and dashes will be displayed in the lower right quadrant. When a valid Loran C signal is received, ELC will be displayed in this quadrant and left or right deviation to the Loran C course will now also be indicated.

When the switch is moved from Loran C to TIME, C will still be displayed in the mode indicator, Loran C left/right deviation will be shown by the light bars and the ECDI timer will now be indicated in the lower right quadrant.

To display NAV 1 deviation either in the VOR or ILS mode, this switch must be first moved to the off position. If desired, the timer can now be used while still displaying NAV 1 deviation.

2.7 FLYING THE ECDI

1. Finding Aircraft Position
    1. Tune desired NAV frequency and identify.
    2. Set TO/OBS/FR/BC selector FR.
    3. Course display shows radial aircraft is on from the VOR.
2. Tracking Direct to the VOR Station
    1. Tune desired NAV frequency and identify.
    2. Set TO/OBS/FR/BC selector switch to "TO".
    3. Push OBS/TEST button and immediately switch "TO" switch to OBS; display will center, turn aircraft toward arrow and maintain aircraft on course "TO" the VOR.
    4. Keep course deviation bar centered by making small aircraft heading changes.

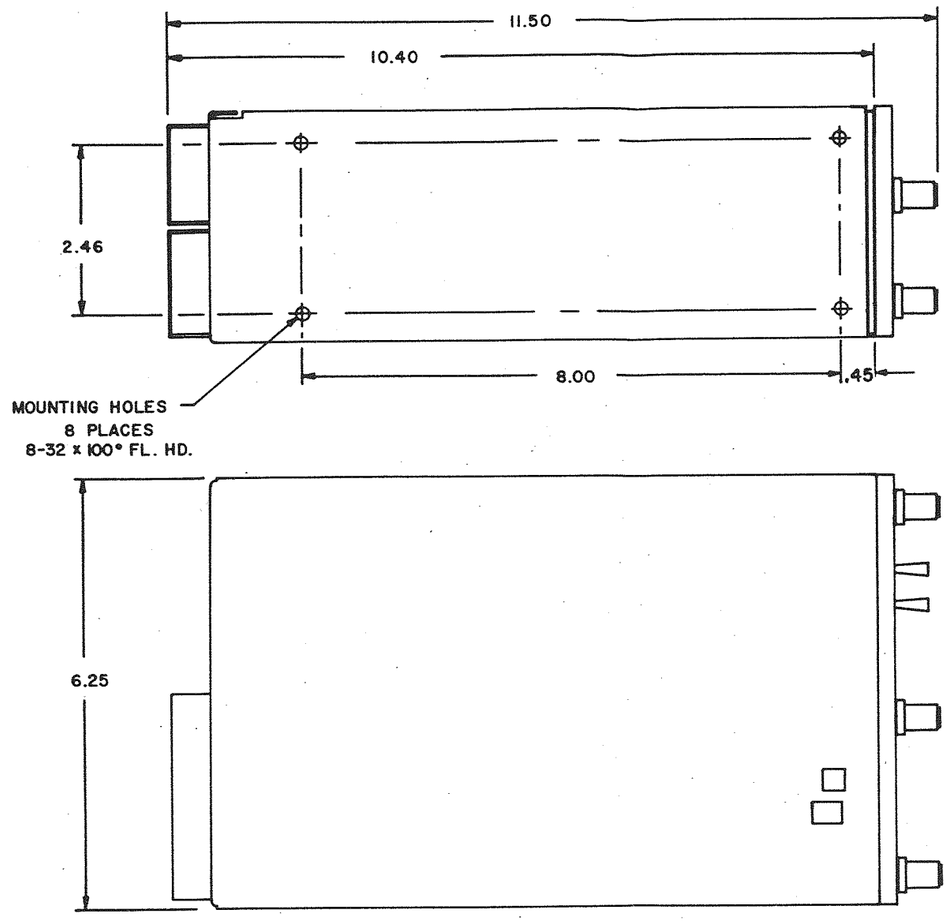
    NOTE: Turn aircraft in direction of arrows, i.e., if bar is going left, left arrow will light, turn left to get back on course.
3. Flying a VOR Airway
    1. Tune desired NAV frequency and identify.
    2. Determine aircraft position (see 1 above.)
    3. Set TO/OBS/FR/BC selector to OBS.

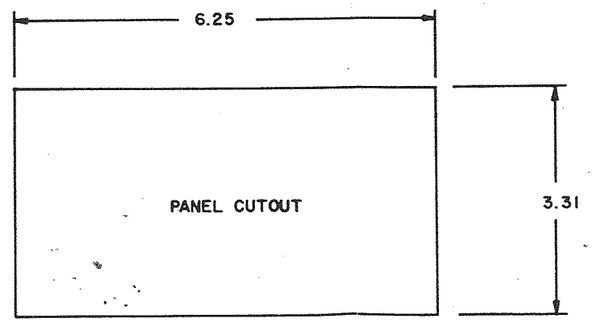
4. Flying a VOR Airway

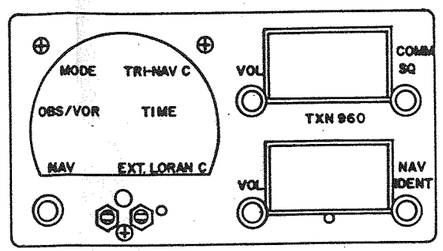
    4. Select desired radial with OBS course selector knob.
    5. Set up intercept and fly to course radial.
    6. When deviation bar centers, turn on course.

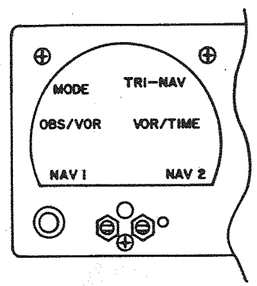
5. ILS Approaches

    1. Tune desired NAV frequency and identify.
    2. Display shows deviation from localizer and glideslope center. That is, if the deviation bar indicates deviation up, then you need to fly up to return to glideslope center.
    3. The course display may be set to the localizer course as a reminder.









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TERRA CORP.			
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DRAWN BY AI S.	TITLE TXN-960 OUTLINE DRAWING		
MECH ENGR APPROVAL			
ELECT ENGR APPROVAL			
PROJ ENGR APPROVAL CDS	SHEET 1 of 1	SIZE D	NUMBER 147-0023-000

REV	E.C.O. Number	DATE
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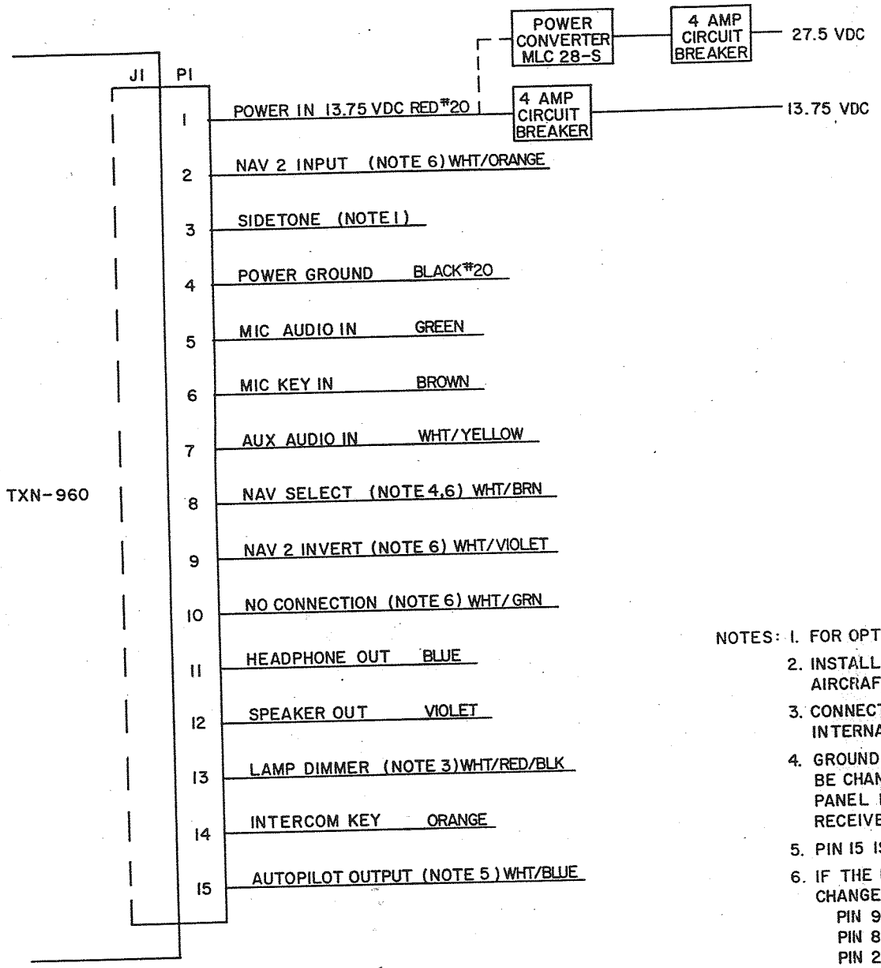
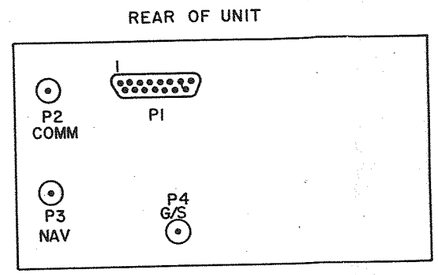
151-0002-000 REV A





NOTES:
1. FOR OPTIONAL SIDE TONE, JUMPER PINS 3 AND 11.
2. INSTALLATION MUST COMPLY WITH STANDARDS SET FORTH IN FAA AIRCRAFT INSPECTION AND REPAIR DOCUMENTS AC 43.13.2 , CHAP. 3.
3. CONNECT P1-13 TO AIRCRAFT 14V LIGHT DIMMER SYSTEM FOR VARIABLE INTERNAL LIGHTING, OTHERWISE CONNECT TO P1-1 FOR CONSTANT LIGHTING.
4. GROUNDING PIN 8 CAUSES INFORMATION FROM THE NAV 2 RECEIVER TO BE CHANNELED TO THE NAV 1 DISPLAY. THE PIN CAN BE WIRED TO A PANEL MOUNTED SWITCH FOR USE IN CASE OF NAV 1 FAILURE OR FOR SWITCHING RECEIVED FLIGHT INFORMATION FROM NAV 1 TO NAV 2.
5. PIN 15 IS + OUTPUT FOR AUTOPILOT COUPLING. USE AIRFRAME GROUND AS − OUTPUT.
6. IF THE UNIT IS EQUIPPED WITH THE LORAN C OPTION THE FOLLOWING WIRING CHANGES MUST BE INCORPORATED.
   PIN 9 TO + RIGHT OUTPUT FROM LORAN C
   PIN 8 TO + LEFT OUTPUT FROM LORAN C
   PIN 2 TO + FLAG OUTPUT FROM LORAN C
   PIN 10 TO − FLAG OUTPUT FROM LORAN C

REV	CO Number	DATE
B		
A	185	4-12-95
ORIGINAL		6-5-84

PART NUMBER	DESCRIPTION	ITEM
←DASH NO	PART NUMBER SCHEDULE	

TERRA CORP.

SCALE NV — Tolerance Unless Noted: .XX ±.01 Fractions ±1/64 .XXX ±.005 Angles ± 1/2°

DRAWN BY A. S.
MECH ENGR APPROVAL
ELECT ENGR APPROVAL
PROJ ENGR APPROVAL CDS

TITLE TXN-960 INTERCONNECT DIAGRAM

SHEET 1 OF 1 | SIZE D | NUMBER 147-0024-000

191-0022-000 REV A

SECTION III

3. WARRANTY

THREE-YEAR LIMITED WARRANTY
TERRA Avionics Corp.

What does your warranty cover?

Any defect in materials or workmanship of Terra equipment.
This warranty applies only to equipment sold after January 1, 1993.

How does your warranty become effective?

Your warranty does not become effective unless you mail your completed Warranty Registration card to us within 15 days after installation of your Terra equipment.

For how long?

Three years from date of original installation of the equipment, but not more than four years from date of purchase.
If you receive repair or replacement of equipment under this warranty, the warranty remains in effect on the repaired or replaced equipment for the remainder of the original three-year term.

What will we do to correct problems?

Repair any equipment found to be defective in materials or workmanship.
If we choose, we may replace the equipment rather than repairing it.
We will be responsible for the cost of labor and materials for repair or replacement of any equipment found to be defective in materials or workmanship.

How do you make a warranty claim?

Contact your nearest Authorized Terra Dealer for repair or replacement of any equipment defective in materials or workmanship.
If directed by your Authorized Terra Dealer, or if you are unable to contact a Terra dealer, send the equipment to our factory:
Properly pack your equipment, we recommend using the original container and packing materials.
Include in the package a copy of the sales receipt or other evidence of date of original purchase and installation. If the equipment was a gift, provide a statement specifying the date received and installed. Also print your name, address, daytime telephone number, and a description of the defect.
Ship the equipment UPS or equivalent. **You must prepay the shipping charges. Ship to:**

Terra Avionics Corporation
3520 Pan American Freeway NE
Albuquerque, NM 87107-4796
(505) 884-2321 Phone (505) 884-2384 FAX

We will pay surface shipping charges to return the equipment to you.

What does your warranty not cover?

Terra equipment purchased "As New" from other than an Authorized Terra Dealer or Distributor.
Malfunctions or failures resulting from the way the equipment was installed or from installation not in accordance with factory instructions.
Certificated Aircraft: Installation by other than an FAA Repair Station (USA), approved installation facility (non-USA) and/or without
- Appropriate air-worthiness approval(s) as required by governing aviation authority;
- Form 337;
- Logbook entry.

Experimental Category Aircraft: Installation without
- Appropriate air-worthiness approval(s) as required by governing aviation authority;
- Form 8130-(x).
- Logbook entry.

Fuses and batteries.
Use of equipment for purposes other than those for which is was designed.
Accidental or deliberate damage, alterations of any kind, inadequate storage or maintenance.
Warranty repair by anyone other than Terra Avionics Corp. or Terra Authorized Dealer with factory approval.

For conditions not covered by this warranty, you will receive an estimate of costs before the repair is initiated. Repairs will be billed to you at the normal repair rates of the facility that performs the repairs.

Are there any other limitations or exclusions?

Any implied warranties are in effect only as long as this warranty is in effect.
This warranty does not cover incidental or consequential damages such as damage to other equipment or to your aircraft that results from defects covered by this warranty.
Some states do not allow limitations on how long an implied warranty lasts, or allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

How does state law relate to this warranty?

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.